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Review article

Republican Arthrology Center and its contribution to the development of orthopedic rheumatology

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Abstract:
The article provides information on the organization and functioning achievements of the Republican Arthrology Center (RAC), which has become the first specialized clinic in the Russian Soviet Federative Socialist Republic (RSFSR) that provided arthrological assistance to the population. The result of the organizational and methodological efforts of the RAC employees was the development of a network of rheumatology rooms in almost all territories of the country, along with the organization of the orthopedic rheumatology service and its separation from the cardiovascular rheumatology service. In the RAC, scientific developments were successfully carried out on the problems of arthroplasty of large joints, surgical and conservative treatment of patients with rheumatoid arthritis, osteoarthritis of large joints, prevention of contractures of the knee joint. Saratov Research Institute of Traumatology and Orthopedics (SRITO) hip joint endoprosthesis, a collapsible endoprosthesis and other constructions that have received wide recognition were created at the RAC. In the absence of international experience in creating an orthopedic rheumatology service network, the RAC was, on one hand, a pioneering phenomenon in world health care, and on the other hand, a natural consequence of the power vertical centralization in the USSR. At the same time, it should be emphasized that the need to create the RAC in the Russian Federation was caused by the growth in morbidity of rheumatic diseases, along with population aging and the prospects of orthopedic rheumatology associated, first of all, with the active introduction of total joint replacement with artificial structures in developed countries of the world. Over three decades of its existence, the RAC has been an organizational, methodological, medical, scientific and consulting center providing an orthopedic care to patients with diseases and injuries of large joints throughout the Russian Federation.

Keywords: history of medicine, arthrology, USSR, republican arthrology center.

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Background

In the USSR, for a long time, joint pathology was not considered the disease that affects the population health index and is socially significant. In the 1960s and 1970s, the entire pathology of bones, muscles, joints, and periarticular soft tissues, both congenital and acquired, was included in a single nosological category. There was no reliable information on the frequency and structure of joint diseases in the country. A significant drawback was the lack of regulatory documents on the number of rheumatological and orthopedic hospital beds, allocated for treating the patients with articular pathology; hence, orthopedic rheumatology patients were hospitalized to the departments of internal diseases, neurology, and orthopedics and trauma. At medical institutions there were no trained professionals for treating the patients with joint diseases.

The prevalence of the most common joint pathology is supported by the following data: in Russia of the 1970s, the incidence of rheumatoid arthritis was 420 cases per 100,000 of the adult population, and for osteoarthritis, it constituted 6,430 cases per 100,000 residents [1]. In 2005, the prevalence of rheumatoid arthritis and osteoarthritis in the United States reached 600 and 12,560 cases per 100,000 adults, correspondingly [2]. The difference between Russia and the United States in the prevalence of these major rheumatic diseases, in which the need for arthroplasty is especially high, could be explained by the living conditions in various population segments, the proportion of elderly and senile in the total population, and the peculiarities of data collection. The trend of an increase in the number of cases in Russia can be traced from more recent statistical data on the dynamics of rheumatic diseases in 2001–2016. During this period of time, the number of patients with rheumatoid arthritis increased by 11%, and those newly diagnosed by 18%; the number of arthrosis patients by 63%, and those newly diagnosed by 34% [3]. These demographic and sanitary epidemiological facts substantiated the search for radical ways in treating the patients with joint diseases, one of which was the joint arthroplasty.

1950s: The Onset of History of Joint Replacement

The history of joint arthroplasty started abroad in the 1950s with the development of unipolar hip endoprostheses. The obtained results gave impetus to the initialization of arthroplasty in the USSR. This was also facilitated by an increase in the number of patients with articular pathologies, especially with osteoarthritis of the hip and knee joints, as well as by high temporary disability among them.

A significant breakthrough in orthopedic rheumatology was the creation of an endoprosthesis for the total hip replacement, consisting of the femoral and pelvic components, by Konstantin Mitrofanovich Sivash in the 1950s [4]. The new prospects for total hip arthroplasty significantly affected the results of surgical treatment of patients with acquired hip joint pathology, in particular, with degenerative coxarthrosis [5].

1970s: Establishment of Republican Arthrology Center (RAC)

By the Order of the Minister of Healthcare of RSFSR, V.V. Trofimov, of August 7, 1973, No. 414, on the basis of Saratov Research Institute of Traumatology and Orthopedics (SRITO), the Republican Arthrology Center (RAC) was established with 50 hospital beds, including 4 for children, 20 for conservative treatment, and 26 for surgical treatment of the patients with joint pathology.

To introduce arthroplasty at the institute, Ya.I. Shersher, the creator of the second domestic endoprosthesis after the device developed by K.M. Sivash, was invited to head the RAC. The first endoprosthesis design by Ya.I. Schercher was distinguished by the improvement of the connection of the femoral component with the pelvic component and more reliable attachment of the acetabular cup to the pelvis; later on, he was the first to propose a collapsible version of the endoprosthesis.

The RAC was the second specialized orthopedic rheumatology center in the USSR, which provided arthrological assistance to the Russian Federation population (the first one was the All-Union Arthrology Center, established in 1971 on the basis of the Division of Arthrology at the Institute for Rheumatism) [6]. The establishment of a specialized arthrology center [7] was dictated by the high prevalence of joint diseases among the population and the need to create a modern orthopedic rheumatology service capable of providing organizational, preventive and therapeutic measures in the republic to ensure the effective surgical care of the patients with joint lesions. Before the establishment of the RAC in the Russian Federation, there was no extensive polyclinic and inpatient network of specialized medical care for rheumatology patients; hence, they were observed and treated by doctors of various medical specialties: rheumatologists, orthopedic traumatologists, surgeons, internists, and neuropathologists.

The attention of scientists and doctors of the RAC was drawn to the organizational and methodological issues of creating an arthrology service in the Russian Federation and solving the problems of hip arthroplasty in case of their damage caused by pathological processes and injuries. The RAC was in close contact with the Institute of Rheumatology of the USSR Academy of Medical Sciences and N.N. Priorov Central Institute of Traumatology and Orthopedics, both of which had provided invaluable assistance to the center in organizing arthrology services in the republic and training scientific personnel.

In order to identify the true prevalence of joint diseases, RAC employees searched for joint disease patients using a special survey method. For example, in 1977, the RAC staff carried out a comprehensive medical examination of 10,000 residents of the Volzhsky District in Saratov, and in 1979, they organized a complete medical examination of nearly 5,000 employees of the machine tool factory and gear-cutting plant of the mechanical engineering industry in Saratov. As a result of the examination, it was revealed that two-thirds of the adult population had degenerative dystrophic lesions of the spine and joints; the second most prevalent disorder was represented by inflammatory rheumatic diseases; and in a small fraction of those examined, extra-articular pathology of soft tissues, pathology of periarticular tissues, and other lesions were diagnosed.

Based on the results of the scientific study, the methodological recommendations were developed, in which rheumatologists of polyclinics were assigned the responsibility of conducting differentiated treatment and clinical examination of patients with osteoarthritis of large joints, rheumatoid arthritis, ankylosing spondylitis and other joint diseases. These recommendations were approved by the RSFSR Ministry of Healthcare. For instance, patients with coxarthrosis or gonarthrosis of stages I-II were subjected to the monitoring by rheumatologists at polyclinics. Those with stages III-IV were subjected to the monitoring by orthopedic traumatologists and referred to specialized medical institutions for various surgical interventions.

1970s-1990s: RAC Development and Achievements

In 1983, the Order No. 420 of the USSR Ministry of Healthcare was issued, according to which rheumatology centers were organized in large cities, and outpatient appointments were scheduled for rheumatology patients in the regions. It is important to point out that in addition to rheumatoid arthritis, the nosology list was supplemented for the first time by the diseases of large joints.

The organizational and methodological work of the RAC staff resulted in creation of a network of rheumatology rooms in nearly all Russian regions. It is necessary to clarify that according to the 1961 order of the USSR Minister of Healthcare, unified cardiovascular rheumatology services were established. Resulting from a number of reasons, the issues of orthopedic rheumatology remained in the background. It is no exaggeration to say that the RAC employees pioneered in organizing the orthopedic rheumatology service, separating it from the cardiovascular rheumatology service. They trained doctors throughout the Russian Federation on how to treat patients with joint pathology. Officially, this activity of RAC was supported by the USSR Ministry of Healthcare in the late 1970s, but work in this direction continued in the 1980s – 1990s. As a result, the condition of the inpatient rheumatology service has improved. The number of specialized divisions had increased in the area of supervision from 53 in 1985 to 82 in 1994 [8]. Organizational principles and stages of rendering assistance to joint disease patients were worked out. Arthrology divisions were opened with the participation of RAC employees in Kemerovo, Sverdlovsk, Murmansk and Chelyabinsk oblasts, and in Stavropol Krai.

The results of field studies, conducted on our business trips, constituted the basis for scientific analysis on investigating the prevalence of rheumatic diseases,

development of measures for preventing their complications, and improvement of clinical screening and diagnosing joint diseases. The RAC also successfully conducted scientific developments on arthroplasty of large joints, surgical and conservative treatment of patients with rheumatoid arthritis and osteoarthritis of large joints, as well as on preventing contractures of the knee joint. In 1973, the first hip replacement surgery was performed in Saratov [9].

The activities of the center are presented in *Figures 1* and *2*, and in *Table 1*. From presented illustrative and statistical materials, an increase in the number of complex reconstructive surgeries on the hip joint, including arthroplasty, as well as of operations aimed at restricting movements in the hip joint via using external fixation devices, can be seen. The majority of surgical interventions were performed on joints of various localizations. In 1990s, the widespread introduction of synovial capsulectomy of the knee joint, simulating resections of the hip joint with plastic surgery using the allografts of the dura mater in rheumatoid arthritis, continued as one of the ways to prevent the development of severe forms of joint deformities. From the first days of RAC functioning, the designs by K.M. Sivash were used, along with the endoprostheses later developed at the institute.

Later Years of RAC Functioning

The RAC professionals developed and introduced into the treatment process a number of original methods and structures, including a device and method for diagnosing the level of damage to the components of the hip joint; a method of skin applications of medicamentous drugs for the treatment of rheumatoid arthritis and osteoarthritis. The RAC has developed an operation for the treatment of patients with severe post-immobilization and post-traumatic contractures of the knee joint using a dura mater allograft as an insert. In post-traumatic and idiopathic osteoarthritis of the knee joint, the developed method for raising the condyles of the tibia was used, which made it possible to ensure an even distribution of body weight on the condyles of femur and tibia, thereby slowing down the progression of osteoarthritis.

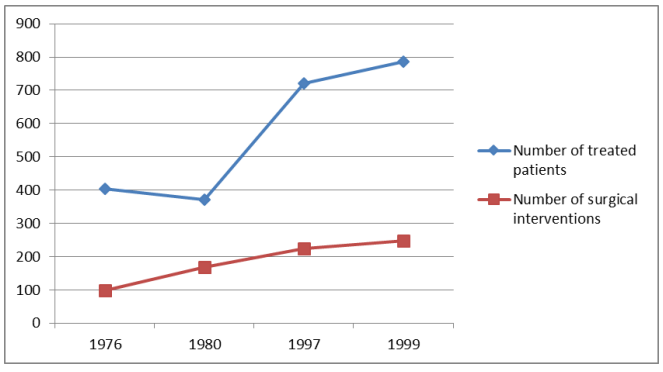

Figure 1. Quantitative indicators of the work of the Republican Arthrology Center functioning. Source: The Archive of SRITO SSMU, reports on the medical treatment at the Institute for 1976, 1980, 1997 and 1999

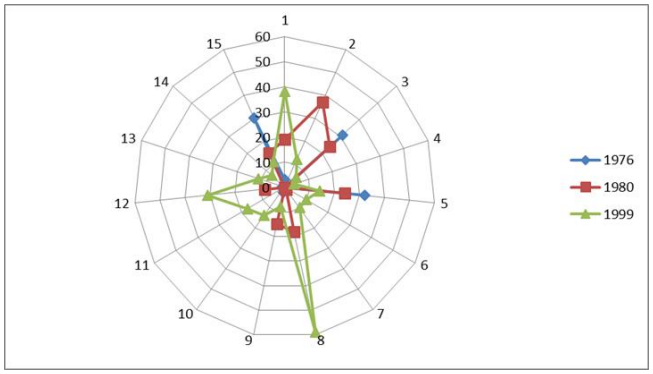

Figure 2. Changes in the nature of surgical interventions at RAC over 1976-1999

1 – total hip arthroplasty; 2 – joint arthroplasty using allografts; 3 – arthrodesis hardware methods for fixing joint-forming bones; 4 – plastic of the acetabulum; 5 – synovial capsulectomy of joints in rheumatoid arthritis; 6 – removal of tumors and exostoses; 7 – ligament surgeries; 8 – removal of menisci and chondromatosis neoplasms; 9 – osteotomy; 10 – removal of metal structures; 11 – osteosynthesis of bone fractures; 12 – restoration of tendons, nerves, skin grafting; 13 – removal of cysts of the popliteal fossa (Baker's cyst); 14 – removal of intra-articular foci of necrosis (Koenig's disease); 15 – other diseases. Source: The Archive of SRITO SSMU, reports on the medical treatment at the Institute for 1976, 1980, 1997 and 1999

Table 1. Structure of patients treated at the Republican Arthrology Center in 1976-1999, numbers

Nosology	1976	1980	1997	1999
Coxarthrosis	102	85	184	220
Gonarthrosis	76	42	96	129
Osteoarthritis of other joints	30	7	36	32
Ankylosing spondylitis	23	17	13	17
Rheumatoid arthritis	-	86	94	95
Reiter's syndrome	1	-	14	4
Arthritis of other etiology	68	12	45	48
Ankyloses and joint contractures	24	12	22	15
Osteochondritis of the spine	17	51	50	49
Synovial chondromatosis and knee meniscus injury	26	3	43	62
Periarticular fractures and their consequences	-	-	54	38
Periarticular tumors	-	-	6	16
Lesions of ligaments, tendons, nerves	-	-	35	30
Other (periarthritis, etc.)	36	32	29	31
Total	403	371	721	786

Source: The Archive of SRITO SSMU, reports on the medical treatment at the Institute for 1976, 1980, 1997 and 1999

If it was necessary to restrict the joint, RAC professionals used their own developments. In particular, a method was developed for arthrodesis of the hip joint with lengthening of the proximal femur by distraction. Treatment of hand joint contractures, along with tendon and nerve injuries, was often accompanied by the use of microsurgical techniques for excision of scars and arthroplasty in the area of the joints.

Particular successes of RAC were associated with the improvement of hip arthroplasty. The creative group of RAC professionals (I.I. Zhadenov, I.D. Kovaleva, V.F. Potekhin, V.M. Ivanov) had created an original collapsible

endoprosthesis of the hip joint. Clinical testing with a long-term follow-up period of up to 10 years exhibited good durability of this design. Over 100 people were operated on, and revision arthroplasty was never required. Another creative group (I.D. Kovaleva, V.F. Potekhin, L.A. Tyshchenko) was engaged in development of a device intended for the surgical prevention of dysplastic coxarthrosis in young people with completed growth. All ongoing experimental and modeling studies were scientifically substantiated from the standpoint of biomechanics of statics and dynamics of the musculoskeletal system. The work of both groups resulted in the creation of the SRITO hip joint endoprosthesis [10], a collapsible endoprosthesis [11], the femoral component of the hip joint [12], and the supraacetabular prosthesis of the acetabulum [13]. The developed endoprostheses received recognition and were protected by copyright certificates of the USSR, patents of Russia and foreign countries, such as USA, Great Britain, France, and Germany.

In 2000, a monograph by I.I. Zhadenov and I.D. Kovaleva, Biomechanical Aspects of Arthroplasty in Coxarthrosis, that summarized the results of 30 years of research by the authors in the field of biomechanics of arthroplasty, was published [14]. It presented the results of the search for optimal forms of endoprostheses based on the principle of biomechanical adequacy; also, it described biological reactions of the tissues in the supraacetabular region and the proximal femur in response to the implantation of metal structures.

A significant place in the research was occupied by the issues related to the study of the pathogenetic mechanisms of articular pathology. A number of scientific studies have been devoted to the pathogenesis of rheumatoid arthritis and osteoarthritis; in the experiment, a positive effect was confirmed in the treatment of adjuvant arthritis with ceruloplasmin [15-18].

Scientific studies on the hemostasis system condition in patients with osteoarthritis of the hip joints before and after arthroplasty, conducted at the RAC, made it possible to significantly reduce the number of hemocoagulation complications in the intra- and postoperative periods due to timely and adequate antithrombotic prophylaxis [19, 20].

For over 30 years of diverse activities at RAC, nearly 100,000 patients have been consulted at the polyclinic; 21,635 people received inpatient treatment (conservative and surgical); more than 6,700 surgeries were performed, including about 1,000 of total hip arthroplasty. Over 50 USSR copyright certificates and RF patents for inventions and certificates for utility models have been received; more than 1,000 articles and 3 monographs have been published [14, 21, 22]; 4 doctoral dissertations have been prepared and defended. The RAC conducted the professional training and retraining of physicians in arthrology. Doctors from all regions of Russia were trained at the center, over 300 methodological recommendations were published, about 100 conferences on arthrology were held, in which over 6,000 physicians have participated.

The 21st Century

Since the beginning of the 21st century, Russia has begun a program for equipping federal medical centers, which ensured the strengthening of the material and technical base and created conditions for provisioning high technology specialized medical care to the population. The need to preserve the RAC was no more relevant. The functions of providing surgeries of the joints to patients were transferred to the federal centers of traumatology and orthopedics, along with divisions of traumatology and orthopedics of both regional and city hospitals. The Research Institute of Traumatology, Orthopedics and Neurosurgery of V.I. Razumovsky State Medical University of Saratov has become one of such federal centers that employed the personnel of RAC.

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Conflict of Interest. Authors declare no conflicts of interest.

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